

4.0 SUMMARY OF RECOMMENDATIONS

The action items and recommendations developed by the process hazard analysis (PrHA) team during the hazard and operability (HAZOP) study are presented in Table 1. The HAZOP study worksheets from which these action items and recommendations were derived are included in Appendix B.

Action items are typically assigned to specific individuals who are named in the “Responsibility” column in the matrix. However, because this report is an example PrHA, this column is left blank.

Table 1. HAZOP Study Action Items

ACTION ITEM	SCENARIO	ACTION	RESPONSIBILITY
1	1-4	Check on the possibility of backflow past the rate indicator (rotameter) and adjust the procedures as needed.	
2	1-9, 3-1	Consider adding a procedure to verify that the vacuum can be maintained after the system is shut down to test for system leak tightness. This procedure should be used when the chlorinators are switched each month and whenever the polyethylene chlorine gas feed tubing is replaced.	
3	1-13	Verify that staff in adjacent buildings have received information on chlorine in their hazard communication (HAZCOM) program .	
4	2-5	Calculate possible temperatures (based on heat input versus heat loss) inside the chlorine cylinder storage facility if the heater thermostat fails “ on ” during peak outside temperatures . Base further action items on the results. Other key equipment affected by excessive temperatures should be considered. See the high-temperature alarm failure incident in Section 6.0.	
5	2-8	Check pressure potential from the chlorine cylinder and the system (regulator) response. Determine whether the fusible plug will open with high pressure .	

Table 1. HAZOP Study Action Items (Continued)

ACTION ITEM	SCENARIO	ACTION	RESPONSIBILITY
6	2-1o, 2-11	Check with the vendor regarding possible entry of material other than chlorine into the chlorine cylinder or the possibility of complete substitution of another chemical that uses the same size container.	
7	3-2	Contact the vendor to determine the failure experience of the regulator failing “open” from wear, corrosion, dirt, or water. If the regulator has a relatively high probability of failing, controls (e.g., a remotely operated shutoff at the chlorine cylinder and failsafe action upon power loss) should be considered.	
8	3-1o	Verify that the screens are in place on the regulator vents.	
9	4-4	The explanation of how the differential pressure regulator operates is missing from the vendor’s documentation. This information should be obtained. The operation of the valve should be checked, and the potential for a pressure deviation should be assessed.	
10	4-13	Verify that monthly preventative maintenance includes checking the battery backup for the chlorine alarm.	
11	5-24	Ensure that the intent to incorporate the existing identification tagging into the disconnect procedures is completed.	
12	6-16	Consult the vendor about what the expected system response would be if the serviceman did not properly vertically align the chlorine tank (drawing liquid to the ejector). Determine the potential amount of chlorine that could be released.	